

**Scientific White Paper:
Summary of Data Supporting the Safety of
ROCKSTAR Energy Drinks**

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Summary of Data Supporting the Safety of ROCKSTAR Energy Drinks

EXECUTIVE SUMMARY

Energy drinks have been targeted in the U.S. media recently in response to reported adverse events - which have been inaccurately reported by the media - and the fact that two U.S. Senators have requested that the U.S. Food and Drug Administration (FDA) investigate the energy drink category. In response to these concerns, Rockstar, Inc. (manufacturer of Rockstar energy drink products) would like to report that an independent Expert Panel has reviewed key ingredients and use levels in Rockstar energy drink products and concluded that the intended use of the key ingredients in all Rockstar products is "Generally Recognized As Safe" (GRAS) based on scientific procedures.

The safety of Rockstar energy drink products is further supported on the basis that:

1. The caffeine content which is listed on the label of Rockstar energy drink products (either 80 mg or 120 mg per 8 oz. serving, depending on product) is less than that of the following Starbucks® coffee:
 - a. Starbucks® "Pike Place® Roast" (standard house blend) 16 ounce Grande coffee contains 330 mgs of caffeine. *(source: Starbucks® website - web link here)*
 - b. Starbucks® "Pike Place® Roast" (standard house blend) 20 ounce Venti coffee contains 415 mgs of caffeine. *(source: Starbucks® website - web link here)*
 - c. Rockstar energy drink products contain either 160 mgs or 240 mgs of caffeine per 16 ounce can, depending on product.
2. Rockstar fulfills all requirements stipulated by the FDA to sell products labelled as either Conventional Foods or as Dietary Supplements.
3. Rockstar energy drink products indicate the total amount of caffeine from all sources on all product labels.
4. Rockstar energy drink products list the following statement on all product labels:
"Not recommended for children, pregnant or nursing women, or those sensitive

to caffeine.”

5. A Panel of independent experts qualified by training and experience to assess the safety of food and food ingredients (the Expert Panel) has critically evaluated the intended conditions of use including use levels and estimated dietary intakes of caffeine in Rockstar energy drink beverages. The Expert Panel applied the requisite safety standard, i.e., there must be a reasonable certainty of no harm under the conditions of intended use of the substance. The Expert Panel unanimously concluded that such use of caffeine is safe and GRAS based on scientific procedures.
6. The Expert Panel also evaluated the intended conditions of use including use levels and estimated daily intakes of taurine, L-carnitine and inositol in Rockstar energy drink products. The Expert Panel unanimously concluded that such uses are safe and GRAS based on scientific procedures.
7. Upon evaluating the intended use included use levels and estimated daily intakes of guarana extract, milk thistle extract and ginseng extract, the Expert Panel unanimously concluded that the use of these extracts in Rockstar energy drink products is safe, and GRAS based on scientific procedures.
8. In evaluating these ingredients, the Expert Panel considered the potential for synergistic effects of the ingredients as well as any known adverse health effects.
9. Claims that the American Academy of Pediatrics recommends no more than 100 mg caffeine per day for adolescents are inaccurate. Neither Rockstar nor the U.S. FDA (FDA letter dated November 21, 2012) has been able to verify this purported recommendation.
10. Adverse event reports do not establish a cause and effect relationship, and the number of such reports for Rockstar is very low in comparison to retail sales of approximately 3 billion cans of Rockstar energy drink products in the USA since Rockstar brand inception in 2001.

The above points are addressed more fully in the following sections of this report.

“Energy drinks” are popular drinks available for purchase at most supermarkets, box stores, grocery stores, convenience stores and gas stations, with current annual unit sales in USA for all brands estimated to be 4.4 billion units (Rockstar personal communication). There are numerous brands of energy drinks currently on the market containing caffeine. Caffeine is the constituent of teas, coffees and colas that is responsible for the increased alertness following consumption.

Since inception in 2001, Rockstar has produced over 3 billion cans of Rockstar energy drink products for the U.S. market. Rockstar energy drink products in the 2013 portfolio contain either 80 mg or 120 mg of caffeine per 8 oz. serving, depending on product.

The FDA posted a summary of adverse effect reports (AER) obtained via the Center for Food Safety and Applied Nutrition Adverse Event Reporting System (CAERS) through October 2012, that related to products marketed as energy drinks or energy shots, which included the brands Red Bull, 5 Hour Energy, Monster, and also Rockstar (U.S. FDA, 2012a). The reports were received under this post-surveillance system between January 1, 2004 and October 23, 2012. It is important to note that these reports cannot determine cause and effect, as stated by the FDA in the summary: *"the adverse effect report itself about a particular product only reflects information AS REPORTED [FDA's emphasis] and does not represent any conclusion by FDA regarding a causal relationship or association with the product or ingredient."*

The summary of CAERS reports (through October 2012) released by the FDA included only 13 reports for Rockstar - including zero deaths - over the 7 year time frame of 2006 to 2012. The lethal dose of caffeine in an average person weighing 150 pounds (68 kg) is approximately 10,000 mg of caffeine, which is equivalent to the consumption of 83 cans of 8 oz. Rockstar or 664 oz. of liquid - putting it in perspective this amount of liquid weighs 43.36 pounds. This volume is 10 times greater than the total amount of fluid that is typically consumed in a day and it is therefore physically impossible to consume this many drinks.

Compared to the over 2 billion cans of Rockstar products sold in the U.S. since 2006 (with over 3 billion sold since brand inception in 2001), the 13 CAERS reports received between 2006 and October 2012 (and it should be noted that these are only recorded in the AER system, and represent no defined relationship or proof of association with the product or ingredient) represent a very small fraction (0.00000065%) of the overall number of units produced since 2006. It is also important to note that of the 13 CAERS reports received regarding Rockstar energy drink products over the 7 year time frame, 6 of those 13 CAERS reports received allegedly claimed either product spoilage or object in can.

The SAMHSA Drug Abuse Warning Network issued a report (SAMHSA, 2011) on hospital visits involving energy drinks (along with alcohol and/or illegal or legal drug abuse or intake) but the report did not specify how many of the visits cited involved Rockstar products. Greater than 50% of patients in the SAMHSA report aged 18 to 25 admitted to combining drug or alcohol use along with the energy drinks. The SAMHSA study did not present any estimate as to the quantity of energy drinks or amount of caffeine consumed, and it cannot be determined if the other half of subjects, particularly younger subjects, willingly disclosed all other drug or alcohol use. Thus, drug and alcohol use in addition to the energy drinks is likely to have been much higher than the admitted 50% identified in the report.

Numerous multi-ingredient foods and beverages contain caffeine including coffee, tea, chocolate, soft-drinks and ice cream, which have a long history of safe consumption in the U.S. and global diet, and are targeted towards all age groups. Regulating food products on the basis of caffeine content would therefore impact many different product categories. Following a comprehensive evaluation of the literature for caffeine, a panel of independent scientists, qualified by scientific training and relevant national and international experience to evaluate the safety of food ingredients, was convened to evaluate the conditions of use of caffeine in Rockstar energy drink products. The Expert Panel unanimously concluded that the intended use of caffeine, produced in accordance with current good manufacturing practice and meeting applicable *Food Chemical Codex specification*, in Rockstar energy drink products at levels up to 120 mg per 8 oz. serving is safe. The Expert Panel unanimously found further that use intended use of caffeine in Rockstar energy drink beverages is GRAS based on scientific procedures. The Expert Panel also noted that, in their unanimous opinion, other qualified experts would concur with these conclusions.

The caffeine level in energy drinks currently manufactured by Rockstar, at 80 mg or 120 mg per 8 oz. serving, is considerably less than in that of an 8 oz. serving of Starbucks or Einstein Bros. coffees, which would provide more caffeine at 160 mg and 150 mg respectively, while the 20 oz. Starbucks Pike Place® Roast coffee contains 415 mg of caffeine. Ben and Jerry's Coffee Heath Bar Crunch also contains 84 mg of caffeine per 8 oz. serving.

Some media reports and health group websites have stated that the American Academy of Pediatrics (AAP) recommends that adolescents (persons ages 12 to 19) should not consume more than 100 mg of caffeine per day. However, following a thorough search of the literature a detailed reference for this statement could not be found in these reports.

In the FDA letter dated November 21, 2012 (U.S. FDA, 2012c), it is stated that the FDA contacted the AAP and reviewed their website but was not able to get verification that the AAP has a policy statement supporting an upper limit of 100 mg caffeine per day for adolescents. We also did an independent search of the AAP website and did not identify any such policy statement. Thus, it is incorrect to state that that the maximum safe amount of caffeine for adolescents is 100 mg per day.

In a letter dated August 10, 2012 concerning caffeine, the FDA stated that while the Agency is reviewing recently published safety studies on caffeine, "the available studies do not indicate any new, previously unknown risks associated with caffeine consumption" (U.S. FDA, 2012b). Furthermore, in another letter dated November 21, 2012 (U.S. FDA, 2012c) the FDA stated that it has "searched the literature but did not find any information that calls into question the safety" of taurine, an amino acid, or guarana, an herb, as currently used in beverages.

Given the above, there is no expectation that consumption of Rockstar energy drink products containing 80 mg or 120 mg of caffeine per 8 oz. serving, in adherence with the product label, should be associated with adverse health effects. Also, the Expert Panel convened to evaluate the safety of caffeine also assessed ginseng extract, guarana extract, L-carnitine, milk thistle extract, inositol and taurine, and concluded unanimously that the use of these ingredients in Rockstar energy drink products are safe. The Expert Panel also found such uses to be GRAS based on scientific procedures. Estimates of dietary intakes of these non-caffeine ingredients from consumption of Rockstar energy drink products were determined to be well below estimates of consumption from other food sources and/or orders of magnitude below no-adverse-effect levels determined from safety studies. As all ingredients are present in amounts that are GRAS and/or are found in various foods in comparable amounts, there is no expected safety concern associated with these ingredients alone, or in combination, from consumption of Rockstar energy drink products.

Summary of Data Supporting the Safety of ROCKSTAR Energy Drinks

1.0 INTRODUCTION

“Energy Drinks” are popular drinks with current USA annual sales for all brands estimated to be 4.4 billion units (Rockstar, personal communication). There are numerous brands of energy drinks currently on the market, with the predominant ingredient being caffeine. Caffeine is the constituent of teas, coffees and colas that is responsible for the increased alertness following consumption. The amounts of caffeine in the individual brands of energy drinks are highly variable as are the serving sizes. Since inception in 2001, Rockstar, Inc. (Rockstar) has produced over 3 billion cans of Rockstar energy drink products for the North American market (Rockstar personal communication).

The U.S. Food and Drug and Drug Administration (FDA) posted a summary of adverse effect reports (AER) obtained via the Center for Food Safety and Applied Nutrition Adverse Event Reporting System, (CAERS) through October 2012 that related to products marketed as energy drinks and energy shots, which included the brands Red Bull, 5 Hour Energy, Monster, and also Rockstar (U.S. FDA, 2012a). The reports were received under this post-surveillance system between January 1, 2004 and October 23, 2012. It is important to note that these reports cannot determine cause and effect as stated by the FDA in the summary: *“the adverse effect report itself about a particular product only reflects information AS REPORTED [FDA’s emphasis] and does not represent any conclusion by FDA regarding a causal relationship or association with the product or ingredient.”*

The purpose of this report is to review the CAERS received through October 2012, and to summarize the data supporting the safety of Rockstar energy drinks.

In considering the safety of Rockstar energy drinks, it is important to clarify that these products are not intended for certain populations known to be sensitive to caffeine. Therefore the label includes a statement that Rockstar products are “not recommended for children, pregnant or nursing women, or those sensitive to caffeine.” Rockstar considers “children” to encompass individuals under age 12.

2.0 COMPARISON OF CAFFEINE CONTENT OF DIFFERENT FOODS

The amount of caffeine in Rockstar energy drink products is comparable to or less than that of standard coffee, which is widely consumed and purchased in specialty coffee shops.

Numerous foods and beverages contain caffeine including coffee, tea, chocolate, soft-drinks and ice cream that have a long history of safe consumption in the U.S. and global diet and are targeted towards all age groups. Regulating food products on the basis of caffeine content would therefore impact many different products. Energy drinks manufactured by Rockstar contain 80 mg or 120 mg of caffeine per 8 oz serving. On a per can basis, caffeine levels of 160 mg to 240 mg would be present in a typical 16 oz container of Rockstar energy drink products. These amounts of caffeine are comparable to brand name coffees that are readily available in the U.S. Concentrations of caffeine present in 16 oz servings of coffee obtained from common U.S. retailers were found to vary from 206 mg (Dunkin Donuts), 300 mg (Einstein Bros.), to 320 mg (Starbucks). Thus, eight ounce servings of Starbucks or Einstein Bros. coffees would provide more caffeine (160 mg and 150 mg, respectively) than would be provided in an 8 oz serving of Rockstar (80 mg or 120 mg, depending on product).

The amounts of caffeine in various energy drinks sold in the U.S. marketplace in serving sizes of 8 oz or greater are summarized in Table 1. The amount of caffeine in Rockstar energy drink products is comparable to most other energy drink brands but is less than one sixth the caffeine concentration of 5-Hour Energy (a concentrated energy shot).

Table 1 Caffeine Content of Select Energy Drinks Available in the U.S. Marketplace

Energy Drinks	Package Size (oz.)	Caffeine (mg)	Concentration (mg/oz.)
NOS	16.0	260	16.3
Rockstar Energy Drink	16.0	160	10.0
Rockstar Sugar Free	16.0	160	10.0
Rockstar Zero Carb	16.0	240	15.0
Monster Energy	16.0	160 (est.)	10.0 (est.)
Monster Lo-Carb	16.0	160 (est.)	10.0 (est.)
Full Throttle	16.0	200	12.5
RedBull	16.0	154	9.6
RedBull Sugar Free	16.0	154	9.6

The amount of caffeine in energy shots, which are a different type of product than energy drinks, is indicated in Table 2.

Table 2 Caffeine Content of Select Energy Shots Available in the U.S. Marketplace			
Energy Shot	Package Size (oz.)	Caffeine (mg)	Concentration (mg/oz.)
5-Hour ENERGY	2.0	200 (est.)	100.0 (est.)

Table 3 lists the caffeine content of other foods and beverages. The amount of caffeine in Rockstar energy drink products on a mg per oz. basis, while about 3 times greater than soft drinks, is less than many coffees and some teas. Ben and Jerry's Coffee Heath Bar Crunch contains as much caffeine as many energy drinks at 84 mg of caffeine per 8 oz. serving.

Table 3 Caffeine Content of Select Food and Beverage Products Available in the U.S. Marketplace			
Product	Package Size (oz.)	Caffeine (mg)	Concentration (mg/oz.)
Starbucks Brewed Coffee (Grande)	16.0	330	20.6
[Pike Place Roast] (Venti)	20.0	415	
Einstein Bros. Regular Coffee (Medium) ^a	16.0	300	18.8
Dunkin' Donuts Regular Coffee (Medium)	16.0	206	12.9
Starbucks Espresso (solo)	1.0	75	75.0
Jolt Cola	12.0	72	6.0
Coca-Cola	20.0	56	2.8
Mt. Dew	20.0	90	4.5
Ben & Jerry's Coffee Heath Bar Crunch	8.0	84	10.5
Ben & Jerry's Coffee Flavored Ice Cream	8.0	68	8.5
Jolt Caffeinated Gum	1 stick	33	33.0 (per stick)
Hershey's Special Dark Chocolate Bar	1.45	31	20.7

Source: CSPI (2007); source ^a = Turcotte (2010)

3.0 CAFFEINE SAFETY ASSESSMENT

Caffeine is present naturally in coffees, teas and herbs and has a long history of safe use in colas and other foods as an added ingredient.

Caffeine is considered safe for use in stimulant drug products for over-the-counter human use to restore mental alertness or wakefulness during fatigue or drowsiness (21CFR 340) (U.S. FDA, 2012d). Use of caffeine in over-the-counter stimulant products to restore mental alertness or wakefulness during fatigue or drowsiness is acceptable for adults and for children 12 years of age and older (*i.e.*, adolescents) and if used at the maximum allowable levels would be over 1000 mg in a day. This amount of caffeine would equal about 8 Rockstar 8 oz. energy drinks.

Thus, it is incorrect to state that the maximum safe amount of caffeine for adolescents is 100 mg per day.

The conditions of use of caffeine in Rockstar energy drinks has been evaluated by an Expert Panel in accordance with sections 201(s) and 409 of the Federal Food, Drug, and Cosmetic Act (U.S. FDA, 2010a,b) and FDA's implementing regulations in 21 CFR 170.3 and 21 CFR 170.30 (U.S. FDA, 2012d). Those regulations state that the use of a food substance may be GRAS either through scientific procedures or, for a substance used in food before 1958, through experience based on common use in food.

Under 21 CFR 170.30(b) (U.S. FDA, 2012d), general recognition of safety through scientific procedures requires the same quantity and quality of scientific evidence as is required to obtain approval of the substance as a food additive and ordinarily is based upon published studies, which may be corroborated by unpublished studies and other data and information.

Under 21 CFR 170.30(c) and 170.3(f) (U.S. FDA, 2012d), general recognition of safety through experience based on common use in foods requires a substantial history of consumption for food use by a significant number of consumers.

The Expert Panel unanimously concluded that the intended use of caffeine, produced in accordance with current good manufacturing practice and meeting applicable *Food Chemical Codex* specification, in Rockstar energy drink products at levels **up to 120 mg per 8 oz. serving** is generally recognized as safe (GRAS) based on scientific procedures.

The primary data noted by the Expert Panel in their evaluation of the safety of caffeine were as follows.

- The estimated lethal dose for caffeine in adult humans is 10,000 mg (Nawrot *et al.*, 2003). For an adolescent this dose would be expected to be closer to the adult estimate than for a child, given their greater body weight and height by age 12, which is more comparable to adults. Intake of 10,000 mg of caffeine, from the proposed food uses of caffeine in Rockstar energy drink products, would require the consumption of eighty-three 8 oz servings, corresponding to 20 liters of fluid **or approximately 43 pounds of Rockstar energy drink, consumed all at one time**. This volume is far in excess of the amount that would be consumed by anyone drinking any beverage, including energy drink consumers.
- Recent comprehensive reviews, conducted by qualified experts, on the reproductive and developmental effects of caffeine in humans have concluded that no adverse consequences on reproduction or pregnancy have consistently been linked to caffeine (SCF, 1999; IOM, 2001; Peck *et al.*, 2010; Brent *et al.*, 2011). However, the European

Commission's Scientific Committee on Food, the IOM, and Health Canada, recommend a reduction in caffeine consumption during pregnancy (SCF, 1999; Nawrot *et al.*, 2003).

- The Expert Panel noted that although infants and children are not intended consumers of energy drinks; consumption by children and potential effects on the developing nervous system of growing individuals should be considered. Caffeine has a long-history of safe use by clinicians for the treatment of apnea in infants. Caffeine and the structurally similar methylxanthine, theophylline, also have been widely used for the treatment of attention deficit disorder (ADHD) and asthma in young and adolescent children (<12 years of age). Under placebo controlled settings, the administration of caffeine (5 mg to 10 mg per kg body weight) to infants within the first 10 days of life for a median duration of 37 days, for treatment of apnea of prematurity, did not affect motor function, cognition, behavior, general health or other developmental measures (e.g., deafness, blindness) during a 5-year follow-up period (Schmidt *et al.*, 2006, 2007, 2012). Meta-analyses of controlled studies evaluating the effects of caffeine on development and behavior in children and adolescents administered caffeine, or the structurally similar methylxanthine theophylline, for treatment of asthma or attention-deficit hyperactivity disorder do not support an association between methylxanthine use and adverse effects on cognition or behavior in these individuals (Lindgren *et al.*, 1992; Stein *et al.*, 1996). The Expert Panel concluded that available evidence do not suggest that dietary caffeine would represent a neurodevelopmental risk to humans of any age group.
- Researchers from the National Institute of Mental Health (Castellanos and Rapoport, 2002) conducted a literature review looking at potential effects of caffeine on developmental and behavior in infancy and childhood. A number of studies conducted from the 1970's to the 1990's were identified including studies in both hyperactive children and normal children. In the hyperactive children, the studies were generally small and adverse effects were noted to be minimal. Expected effects such as dose-dependent insomnia and minor increases in blood pressure and heart rate at doses of 320 mg were observed. In studies in normal children, low doses (~3 mg per kg) were not associated with any effects, while higher doses (~10 mg per kg) were reported to be associated with improvements in vigilance but also "fidgetiness" and "jumpiness". As such effects are typical for caffeine, it was concluded that effects of caffeine at moderate caffeine intakes were "modest" and "innocuous" (Castellanos and Rapoport, 2002). In an earlier review (Leviton, 1992), typical caffeine consumption among children obtained from sources such as coffee, tea, colas and chocolate was not found to be associated with adverse effects. It was noted from a study comparing responses to caffeine in boys and adult men that children were less likely than men to report caffeine related subjective effects such as faint, flushing or nervous/jittery.

- Coffee has been shown to have hypercholesterolemic properties (Jee *et al.*, 2001) and both coffee and caffeine have been shown to have hypertensive properties (Nurminen *et al.*, 1999; Nawrot *et al.*, 2003; Noordzij *et al.*, 2005); however, there is no definitive evidence to suggest that these effects would result in any long-term adverse effects since available epidemiological data have not demonstrated a clear and consistent association between coffee consumption and risk of coronary heart disease and hypertension. The IOM and Health Canada both state that 'moderate' caffeine intake does not adversely affect cardiovascular health (IOM, 2001; Nawrot *et al.*, 2003) with Health Canada further specifying 'moderate' as ≤ 400 mg caffeine per day (up to 4 cups of coffee) Nawrot *et al.*, 2003).
- Controlled metabolic studies in healthy adult subjects show that oral doses of caffeine can negatively affect calcium balance (Heaney and Recker, 1982; Massey and Wise, 1984; Bergman *et al.*, 1990). The magnitude of this effect is small. Urinary calcium losses of 5.1 mg and 7 mg have been reported in healthy male subjects administered oral caffeine doses of 3 or 6 mg per kg body weight respectively (Massey and Hollingbery, 1988). These urinary losses of calcium are equivalent to the quantity of calcium in 2 tablespoons of milk (Heaney, 2002), and among individuals consuming adequate calcium in the diet the effects of caffeine on calcium balance are nutritionally irrelevant. Comprehensive reviews of intervention and observational studies evaluating the association between caffeine and/or coffee intake and measures of bone health have been conducted by authoritative scientific bodies including the IOM and Health Canada (IOM, 2001; Nawrot *et al.*, 2003). The IOM concluded that an association between caffeine consumption and bone health cannot be established (IOM, 2001). Health Canada more specifically concluded that caffeine intakes ≤ 400 mg per day (up to 4 cups of coffee per day) do not have adverse effects on bone status or calcium balance in individuals meeting their recommended calcium intakes (Nawrot *et al.*, 2003). The Expert Panel similarly concluded that the effect of dietary caffeine from the proposed food uses of caffeine in energy drinks would be negligible among individuals consuming adequate quantities of calcium in the diet.
- Caffeine at doses of 250 mg or more may have a mild, transient diuretic effect, especially among infrequent users. However, regular caffeine users become habituated to the effects of caffeine, diminishing its actions (Armstrong, 2002; Maughan and Griffin, 2003). Overall, beyond a mild transient diuretic effect, there is no substantive evidence to indicate that moderate caffeine consumption in beverage form results in biologically significant changes in hydration status in subjects, either at rest or under exercise conditions, who consume an otherwise normal diet (Grandjean *et al.*, 2000; Armstrong, 2002; Roti *et al.*, 2006; Goldstein *et al.*, 2010; Campbell *et al.*, 2013). Caffeine doses of 600 mg to 900 mg (approximately 6 to 9 cups of coffee) may increase fluid and electrolyte

losses in urine; however, a normal diet will replace these losses (IOM, 2001). Total body water loss depends on the amount of caffeine consumed, the individual's history of caffeine use, the total solute load of food/beverage intake, and environmental/physical stresses (e.g., temperature, level of exercise) (IOM, 2001).

- Caffeine has been shown to have stimulatory effects, increasing performance, vigilance, alertness, memory, and mood (Nehlig *et al.*, 1992; Riedel *et al.*, 1995; Fredholm *et al.*, 1999; ANZFA, 2000; Lieberman *et al.*, 2002; Smith, 2002). Higher doses (reported differentially in the literature as >300, >400 or >500 mg caffeine per day) have demonstrated negative effects, such as feelings of anxiety, *nausea*, jitteriness, and nervousness (Greden, 1974; Lader and Bruce, 1986; Lieberman, 1992; Green and Suls, 1996; Garrett and Griffiths, 1997; Childs and de Wit, 2006). Individuals with panic and/or anxiety disorders may be particularly sensitive to the anxiogenic effects of caffeine (Lara, 2010). However, the negative effects of caffeine on anxiety and sleep appear to be self-limiting – *i.e.*, individuals aware of their sensitivities limit their caffeine intakes.
- Caffeine users can become physically dependent on caffeine, demonstrating minor withdrawal symptoms, notably headache, with cessation of intake (Ozsungur *et al.*, 2009; Sigmon *et al.*, 2009).
- Studies suggest that caffeine has similar anxiogenic and withdrawal effects in younger individuals as seen in adults (Meltzer *et al.*, 2008). Health Canada regards children as an 'at risk' subgroup that may require specific advice on moderating their caffeine intake and suggests a caffeine consumption of ≤ 2.5 mg per kg body weight/day in children under 12 years of age (Nawrot *et al.*, 2003; Health Canada, 2011).
- Concurrent consumption of caffeine and certain medications can result in significant changes in the pharmacokinetics of both caffeine and/or the interacting drug (Durrant, 2002; Broderick *et al.*, 2005). It should be noted that the Rockstar energy drink product labels contain the admonition that persons sensitive to caffeine should avoid the product.

The Expert Panel was aware of increasing concerns expressed in the literature by various scientific and medical experts, including regulators, regarding the safety of caffeinated energy drink use by teenagers (e.g., Schneider and Benjamin, 2011; Seifert *et al.*, 2011; Wolk *et al.*, 2012). The dietary intake analyses indicated that, among teenagers, the use of energy drinks was a greater contributor of caffeine intake than the background diet. However, at the 90th percentile, based on NHANES data, the caffeine intakes contributed by the background diet (*i.e.*, food and dietary supplements) and consumption of energy drinks were below the 400 mg per day level commonly cited by regulatory and authoritative bodies as not associated with adverse effects. The FDA recognizes that "*for healthy adults, caffeine intake up to 400 mg per day is not associated with general toxicity, cardiovascular effects, effects on bone status and calcium*

balance (with consumption of adequate calcium), changes in adult behavior, incidence of cancer, or effects on male fertility" (U.S. FDA, 2012b). The Expert Panel also noted that Rockstar products containing caffeine as an ingredient bear the following label statement: "Not recommended for children, pregnant or nursing women, or those sensitive to caffeine." Following the Expert Panel's comprehensive review of all available scientific evidence related to the safety of caffeine, it was unanimously concluded that the intended use of caffeine, produced in accordance with current good manufacturing practice and meeting applicable Food Chemicals Codex specifications, in Rockstar energy drink beverages at levels up to 120 mg per 8 oz. serving, is generally recognized as safe based on scientific procedures. The Expert Panel also noted that, in their unanimous opinion, other qualified experts would concur with these conclusions.

4.0 SUMMARY OF CAERS REPORTS

Adverse events reports are not considered reliable indicators that energy drinks pose safety concerns.

The FDA Center for Food Safety and Applied Nutrition (CFSAN) Adverse Event Reporting System (CAERS) is a post marketing surveillance system. CAERS includes mandatory reports of serious (*e.g.*, death and injury) adverse events related to dietary supplements, and voluntary reports of serious and non-serious adverse events related to beverages or conventional foods. Non-serious adverse events (*e.g.*, reversible non-life threatening effects) linked to dietary supplements also may be voluntarily reported. Voluntary reports may be filed by the public or medical professionals.

A filing of a CAERS report is not sufficient to prove cause and effect. Thus, the CAERS reports do not prove that energy drinks caused any adverse health effects reported. As stated by the FDA *"The existence of an adverse event report does not necessarily mean that the product identified in the report actually caused the adverse event."* The FDA carefully investigates and evaluates other possible causes before deciding whether the product actually caused the reported adverse event.

Deficiencies of CAERS which can preclude identification of a cause and effect relationship, as noted by the FDA itself (<http://www.fda.gov/Food/NewsEvents/ucm328536.htm>) (U.S. FDA, 2012a), include:

- *"reports with incorrect, incomplete or no contact information, which make following up with the complainant difficult or impossible;*
- *variability among the completeness of the reports. Some reports may consist only of a single sentence with little detail;*

- *reports that list the brand, but do not identify the specific product;*
- *absence of or lack of FDA access to other information related to the report, such as medical records and medical histories (In fact, some state medical privacy laws prevent FDA from obtaining medical records related to the adverse event report.);*
- *use of other supplements or medications at the same time;*
- *pre-existing or undiagnosed medical conditions;*
- *improper use of the product"*

The summary of CAERS reports through October 2012 released by the FDA included only 13 reports for Rockstar and zero deaths (over the timeframe of 7 years – 2006 to October 2012). Among the other energy drink brands there were 21 CAERS reports and zero deaths for Red Bull (from 2004 to October 2012), 40 reports including 5 deaths, for Monster (from 2004 to October 2012), and 92 reports including 13 deaths for 5-Hour Energy (from 2005 to October 2012). More than half of the reports of death for these other brands gave no information on symptoms leading up to death. Other reports provided some description in addition to "death" that was confounding including the following:

- fall and head injury (Report #121679, 5-Hour Energy); this same case seems to have been reported twice (Report #s 121679 & 121680, 5-Hour Energy) as case was for the same date and numbers are sequential)
- pneumonia and acute respiratory failure (Report #129061, 5-Hour Energy)
- suicide (Report #155230, 5-Hour Energy).

Other reports for 5-Hour Energy (Report #s 137118, 144858, 157207) noted that death followed myocardial infarctions (heart attacks) however no information was given on the pre-existing health of the patient. As there are approximately 1.5 million cases of myocardial infarction per year in the U.S., with 30% resulting in death, it is not possible to conclude from the CAERS report alone that the few cases noted were in fact caused by energy drinks.

Furthermore, based on literature reports, the amount of caffeine that would be fatal to humans if consumed all at once is approximately 10,000 mg in adults. To put this into perspective, that is the amount of caffeine in 83 cans of 8 ounce Rockstar (containing 120 mg caffeine), or 656 total ounces - **approximately 43 pounds of Rockstar**. Rockstar energy drink products include a statement on the label that the products should not be consumed by children (<12 years of age). Total fluid (all drinks and water) intake per day is usually 67 oz. (2 liters) for adults. Therefore, individuals would need to consume about 10 times more energy drinks than the typical full day fluid amounts, and in a short timeframe, to reach fatal levels of caffeine.

Certain media reports have contended that the number of incidents of emergency department visits and adverse events attributable to energy drinks is much higher than that suggested by

CAERS. As the basis for this contention, the media has cited a report by the Substance Abuse and Mental Health Services Administration (SAMHSA), dated November 22, 2011, entitled: "The DAWN Report: Emergency Department Visits Involving Energy Drinks" where DAWN stands for Drug Abuse Warning Network. SAMHSA determined that there were 16,053 and 13,114 energy drink-related emergency department visits in 2008 and 2009, respectively, noting that the amount of caffeine in a can or bottle of energy drink can vary from about 80 mg of caffeine to more than 500 mg (SAMHSA, 2011); however precise estimates of caffeine intake associated with each visit are not provided. DAWN is noted to be a public health surveillance system that "monitors" drug related emergency visits where the visit is classified as a DAWN case if it involves drugs. A drug is defined as "alcohol; illegal drugs, such as cocaine, heroin, and marijuana; pharmaceuticals (e.g., over-the-counter medicines and prescription medications); and nutraceuticals, such as nutritional supplements, vitamins, and caffeine products."

The report indicates that for more than half of the visits in which energy drinks were reportedly used (brands not specified) in the 18 to 25 year age range, the subjects also reported using alcohol and other drugs. Since this was likely to have been a self-reporting system it is probable that the use of alcohol and illicit drugs would have been under reported especially in those subjects below the legal drinking age of 21. For the DAWN report, the information is collected from the chart documents. The patient outcomes were not provided. However it was noted that 57 percent of visits involving energy drinks in combination with drugs were classified as "misuse or abuse" while 30 percent were classified as "adverse reactions." No other information, such as the specific energy drinks consumed, or the amounts of energy drinks and drugs consumed were provided in the DAWN report. Likewise, no precise estimate of caffeine intake associated with each visit was provided.

In an update to this report, SAMHSA (2013) reported an increase in emergency department visits to 20,783 in 2011 supposedly attributed to energy drink consumption. In comparison, the number of visits in 2007, 2008, 2009 and 2010 were 10,068, 16,053 13,114 and 15,219 respectively and so over the timeframe from 2007 to 2011, there were both increases and decreases in the number of incidents that occurred annually. In addition, the number of visits involving adverse reactions involving the misuse or abuse of drugs, also approximately doubled with almost half of the total reported incidences being associated with pharmaceuticals, illicit drugs and alcohol. With such confounding factors it cannot be determined from the information provided what role, if any, the energy drink contributed to the visit and/or the symptoms. Furthermore, given that it was a self-reporting system it cannot be determined if those subjects visiting the emergency department, particularly younger patients disclosed all other concomitant drug or alcohol use. Again, information on the amounts of caffeine intake or the type of energy drink/shot consumed was not determined.

4.1 Incidence of Adverse Reports Versus Volumes Sold

The total number of CAERS reports (through October 2012) over the past 9 years for energy drinks (166) is very low compared to the number of units of energy drinks that have been consumed. It is estimated that the current annual energy drink consumption in the USA is on the order of 4.4 billion units.

Rockstar since inception in 2001 has produced over 3 billion cans of Rockstar energy drink products for the U.S. market, and approximately 2 billion since 2006. The 13 CAERS reports received between 2006 and October 2012 represent a very small fraction (0.00000065%) of the overall number of units produced since 2006, with none proven to be causative to drinking Rockstar energy drinks. It is also important to note that of the 13 CAERS reports received regarding Rockstar energy drink products over the 7 year time frame, 6 of those 13 CAERS reports received allegedly claimed either product spoilage or object in can.

The numbers of visits in the DAWN report estimated for the U.S. are actually based on a "probability sample" of hospitals rather than real numbers. For the visits involving drugs and alcohol, it cannot be determined from the information provided what, if any, role the energy drink would have contributed to the symptoms. For hospital visits attributed to energy drinks alone, it cannot be determined if patients, particularly younger patients, disclosed all other drug use or alcohol. Nevertheless, in the unlikely event that all 20,783 visits in 2011 (the highest number of visits noted) were related to energy drinks, the incidence of visits compared to the annual energy drink consumption estimate, in 2011, of 3.5 billion would be approximately 0.000006% or 1 visit for every 168,400 units sold. Excluding the alcohol and drug combination use, the incidence would be approximately 0.0000034% or 1 visit for every 290,360 units sold. Further, it should be noted that according to the Centers for Disease Control and Prevention, the number of emergency department visits from all causes in 2011 was 136,100,000 in total.

5.0 CONSIDERATION OF CAFFEINE CONSUMPTION BY ADOLESCENTS

Caffeine has been used clinically in the treatment of apnea in infants at doses of 5 to 10 mg per kg body weight (*i.e.*, ~100 mg total), as well as in the treatment of attention deficit disorder (ADHD) and asthma in young and adolescent children (<12 years of age). There is no expectation that adolescents (individuals 12 to 18 years of age) should be unduly sensitive to caffeine in comparison to infants and children. Consequently, it is incorrect to state that 100 mg of caffeine per day is the maximum safe amount for adolescents (12 years of age and older). Literature searches were conducted to identify additional studies specific to adolescents given the recent media concerns about the consumption of energy drinks in this age group.

